

BAYOU TECHE TMDL FOR SULFATE
SUBSEGMENT 060301 (inclusive of subsegment 060205)

US EPA Region 6

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EXECUTIVE SUMMARY

Section 303(d) of the Federal Clean Water Act requires states to identify waterbodies that are not meeting water quality standards and to develop total maximum daily pollutant loads for those waterbodies. A total maximum daily load (TMDL) is the amount of a pollutant that a waterbody can assimilate without exceeding the established water quality standard for that pollutant. Through a TMDL, pollutant loads can be distributed or allocated to point sources and nonpoint sources discharging to the waterbody. A TMDL has been developed for sulfate for Bayou Teche.

Bayou Teche flows from its headwaters in South Central Louisiana to Charenton Drainage Canal and Lower Bayou Teche. Subsegment 060301 (inclusive of the former subsegment 060205) was listed on the Court Ordered §303(d) list as not fully supporting the water quality standard for propagation of fish and wildlife and was ranked as a high priority for TMDL development. This TMDL addresses this listing. Louisiana's water quality standards for chloride, sulfate, and TDS are applied as follows:

“Numerical criteria for these parameters generally represent the arithmetic mean of existing data from the nearest sampling location plus three standard deviations. For estuarine and coastal marine waters subsegments in Table 3 that have no listed criteria (i.e., designated N/A), criteria will be established on a case-by-case basis using field determination of ambient conditions and the designated uses. For water bodies not specifically listed in the Numerical Criteria and Designated Table, increases over background levels of chloride, sulfate, and TDS may be permitted. Such increases will be permitted at the discretion of the office on a case-by-case basis and shall not cause in-stream concentrations to exceed 250, 250, and 500 mg/l for chloride, sulfate, and TDS, respectively, except where a use attainability analysis indicates that higher levels will not affect the designated uses. In permitting such increases, the office shall consider their potential effects on resident biota and downstream water bodies in addition to the background conditions. Under no circumstances shall an allowed increase over background conditions cause any numerical criteria to be exceeded in any listed water body or any other general or numerical criteria to be exceeded in either listed or unlisted water bodies.”

Seven months (June, 1998 – December, 1998) of monthly LDEQ monitoring data on Bayou Teche (WQ site 673) were assessed to determine if the propagation of fish and wildlife use was being maintained. Analysis of the data shows that the propagation of fish and wildlife use is not protected. Greater than 30% of the measurements exceeded the sulfate criterion of 30mg/l (see Appendix A). Therefore, a TMDL was developed to protect the propagation of fish and wildlife use.

For the purpose of TMDL development, the criterion of 30 mg/L was applied. The sulfate TMDL was developed based on simple dilution calculations using average flow and the state sulfate criterion of 30 mg/L for this subsegment. The TMDL calculation includes a wasteload allocation, a load allocation, and a margin of safety. A 14.5% reduction in sulfate loading will be needed to meet the standard for the propagation of fish and wildlife.

1. Introduction

Bayou Teche, subsegment 060301 (inclusive of the former subsegment 060205) was listed on the October 28, 1999 Court Ordered §303(d) list as not fully supporting the water quality standard for the propagation of fish and wildlife use and was ranked as a high priority for TMDL development. A TMDL for sulfate was developed in accordance with the requirements of Section 303 of the federal Clean Water Act. The purpose of a TMDL is to determine the pollutant loading that a waterbody can assimilate without exceeding the water quality standard for that pollutant; the TMDL also establishes the load reduction that is necessary to meet the standard in a waterbody. The TMDL consists of the wasteload allocation (WLA), the load allocation (LA), and a margin of safety (MOS). The wasteload allocation is the load allocated to point sources for the pollutant of concern and the load allocation is the load allocated to nonpoint sources. The margin of safety is a percentage of the TMDL that accounts for the uncertainty associated with the model assumptions and data inadequacies.

2. Study Area Description

2.1 Bayou Teche, Subsegment 060301

Bayou Teche flows through the Vermilion-Teche River Basin in South Central Louisiana. Subsegment 060301 (inclusive of the former subsegment 060205) runs from the headwaters at Bayou Courtableau to the Keystone Locks and Dam. The Vermilion-Teche River Basin lies in the Western Gulf Coastal Plain ecoregion. The watershed is characterized as plains/prairie, and the land is generally flat with a very gradual slope toward the Gulf of Mexico. The major land uses are listed in Table 1 (LDEQ 1993).

Table 1. Land Use for segment 0603 of the Vermilion-Teche River Basin

Land Use Type	Number of Acres	% of Total Area
Urban	186	35.3
Extractive	47	8.9
Agricultural	294	55.8
Forest	0	0
Water	0	0
Wetland	0	0
Barren Land	0	0
TOTAL AREA	527	100.0

2.2 Water Quality Standards

The designated use for Bayou Teche includes the propagation of fish and wildlife. Sulfate is a water quality criterion used for assessment of use support. Louisiana's water quality criterion for sulfate is 30 mg/L (Subsegment 060301).

2.3 Identification of Sources

The sources identified in the *1998 Louisiana Water Quality Inventory* as affecting the water quality of Bayou Teche are designated as irrigated/non-irrigated crop production and minor industrial point sources (LDEQ 1998).

2.3.1 Point Sources

There are 16 permitted facilities (with known flow information) discharging sanitary wastewater into Subsegment 060301. The combined flow of all these discharges is 6,157,390 gallons per day (see Table 2) (Carney, 2000).

Table 2. Dischargers in Subsegment 060301

Facility	Permit	Flow (MGD)	Load (lb/day)*
LA Sugar Cane Coop Inc.	LA0000787	0.18	45.04
Dallas Trailer Park	LAG530160	0.0024	0.60
Acadiana Treatment System Inc.	LAG530027	0.003	0.75
St. Martin Parish School Board	LAG540696	0.009015	2.26
St. Landry Parish School Board	LAG540689	0.007875	1.97
CBS Enterprises, CBS MHP	LAG540226	0.0156	3.90
St. Landry Parish Sewer District #1	LA0057401	0.048	12.01
Town of Port Barre WWTP	LA0020419	0.5	125.1
Stelly Construction Inc.	LA0105562	0.0002	0.05
Charles G. Lawson Trucking Inc.	LA0109151	0.0035	0.88
Savoie's Sausage and Food Production	LA0095184	0.013	3.25
Koch Gateway Pipeline Co. – Opelousas Comp Stn	LA0108839	0.0031	0.78
St. Martin Police Jury and Others	LA0043991	3.0	750.6
Bent Oak Trailer Park	LAG540911	0.0177	4.43
LA Sugar Coop., Inc.	LA0004375	0.864	216.17
City of St. Martinville	LA0040941	1.49	372.80
Total Load:			1540.59

*load calculated using design flow and 30mg/L sulfate criterion.

2.3.2 Nonpoint Sources

The predominant land uses in the area of Bayou Teche are agriculture and forestry, and to a lesser extent, urban uses. It is presently unknown to what relative extent these sources contribute to sulfate loads through runoff.

3. TMDL Load Calculations

3.1 Current Load Evaluation

Sulfate loads have been calculated using the instream sulfate concentration and the flow of the stream. The following equation can be used to calculate sulfate loads.

$$\text{Equation 1. } C \times Q \text{ in cfs} \times 5.39 \text{ or } C \times Q \text{ in MGD} \times 8.34$$

Where: C = concentration in mg/L

Q = stream flow in cfs or MGD

A traditional expression of the loading may be developed by setting one critical or representative flow and concentration, and calculating the sulfate load using Equation 1. The difficulty with this approach is in the determination of the appropriate flow or concentration value to use.

For the purpose of calculating current loading on this waterbody the average sulfate concentration was calculated using monthly LDEQ monitoring data on Bayou Teche (WQ site 673). WQ site 673 was used because it is located at the most downstream end of subsegment 060301 and is considered to be most representative of this subsegment. In Bayou Teche, the monthly sulfate concentrations ranged from 8.2 mg/L to 58.3 mg/L over a seven month period (June, 1998-December, 1998). The average sulfate concentration was 35.08 mg/L (see Appendix A).

The average flow for Bayou Teche is 760 ft³/sec (see Appendix B). Using these values and Equation 1 it is estimated that the current loading is 143,702 lb/day.

3.2 TMDL

Point sources usually have a defined critical receiving stream low flow such as the 7Q10 (or Harmonic mean flow) at which the criterion must be met. For nonpoint sources it is recognized that there may be no single critical flow condition. The load reduction needed to meet the water quality standard for propagation of fish and wildlife in Bayou Teche at 760 cfs is 20,810 lb/day (14.5% reduction). This was obtained by calculating the allowable TMDL at 760 cfs for the 30mg/L criterion (122,892 lb/day) and subtracting this load from the observed load (143,702 lb/day).

$$\text{TMDL} = \text{Cstd} \times Q \text{ cfs} \times 5.39, \quad \text{where Cstd} = 30 \text{ mg/l, } Q = 760 \text{ cfs}$$

$$\text{TMDL} = 30 \text{ mg/l} \times 760 \text{ cfs} \times 5.39 = 122,892 \text{ lb/day}$$

$$\text{Current Load} - \text{TMDL} = \text{Load Reduction}$$

$$143,702 \text{ lb/day} - 122,892 \text{ lb/day} = 20,810 \text{ lb/day}$$

3.3 Wasteload Allocation (WLA)

The Louisiana Water Quality Regulations require permitted point source discharges of treated sanitary wastewater to maintain an in-stream sulfate concentration of 30 mg/L on this subsegment.

Equation 1 can be used to calculate the total point source load (wasteload allocation) utilizing a sulfate concentration of 30 mg/L and the total volume of all the wastewater dischargers (6,157,390 gallons/day).

$$30 \text{ mg/L} * Q \text{ in MGD} * 8.34 = \text{WLA}$$

Where Q = Total volume of sanitary wastewater discharges into Bayou Teche

$$\text{WLA for all dischargers} = 1541 \text{ lb/day}$$

3.4 Load Allocation (LA)

The load allocation for a given flow can be calculated using Equation 1 and the following relationship:

$$(\text{TMDL@ given flow and criterion}) - (\text{WLA}) = \text{LA}$$

$$\text{LA at an instream flow of 760 cfs} = 121,351 \text{ lb/day}$$

$$122,892 \text{ lb/day (TMDL@ 760 cfs)} - 1541 \text{ lb/day (WLA)} = 121,351 \text{ lb/day}$$

3.5 Seasonal Variation

Louisiana's water quality standard for sulfate is for January through December. Therefore, no seasonal TMDL for sulfate was developed.

3.6 Margin of Safety (MOS)

The Clean Water Act requires that TMDLs take into consideration a margin of safety. EPA guidance allows for the use of implicit or explicit expressions of the margin of safety or both. When conservative assumptions are used in the development of the TMDL or conservative factors are used in the calculations, the margin of safety is implicit. When a percentage of the load is factored into the TMDL calculation as a margin of safety, the margin of safety is explicit. In this TMDL for sulfate, conservative assumptions have been used and therefore, the margin of safety is implicit. These conservative assumptions are:

- Using average flows to calculate current loading to obtain load reduction.
- Treating sulfate as a conservative pollutant, that is, a pollutant that does not degrade in the environment.
- Using the sulfate water quality standard of 30 mg/l rather than using site-specific criteria and seasonal variability factors.
- Using the design flow (where available) of the point source dischargers rather than actual average flow rates, which are typically much lower.

4. Other Relevant Information

Although not required by this TMDL, LDEQ utilizes funds under Section 106 of the federal Clean Water Act and under the authority of the Louisiana Environmental Quality Act to operate an established program for monitoring the quality of the state's surface waters. The LDEQ Surveillance Section collects surface water samples at various locations, utilizing appropriate sampling methods and procedures for ensuring the quality of the data collected. The objectives of the surface water monitoring program are to determine the quality of the state's surface waters, to develop a long-term data base for water quality trend analysis, and to monitor the effectiveness of pollution controls. The data obtained through the surface water monitoring program is used to develop the state's biennial 305(b) report (*Water Quality Inventory*) and the 303(d) list of impaired waters. This information is also utilized in establishing priorities for the LDEQ nonpoint source program.

The LDEQ has implemented a watershed approach to surface water quality monitoring. Through this approach, the entire state is sampled over a five-year cycle with two targeted basins sampled each year. Long-term trend monitoring sites at various locations on the larger rivers and Lake Pontchartrain are sampled throughout the five-year cycle. Sampling is conducted on a monthly basis or more frequently if necessary to yield at least 12 samples per site each year. Sampling sites are located where they are considered to be representative of the waterbody. Under the current monitoring schedule, targeted basins follow the TMDL priorities. In this manner, the first TMDLs will have been implemented by the time the first priority basins will be monitored again in the second five-year cycle. This will allow the LDEQ to determine whether there has been any improvement in water quality following establishment of the TMDLs. As the monitoring results are evaluated at the end of each year, waterbodies may be added to or removed from the 303(d) list. The sampling schedule for the first five-year cycle is shown below. The Vermilion-Teche River Basin will be sampled again in 2003.

1998 – Mermentau and Vermilion-Teche River Basins
 1999 - Calcasieu and Ouachita River Basins
 2000 – Barataria and Terrebonne Basins
 2001 – Lake Pontchartrain Basin and Pearl River Basin
 2002 – Red and Sabine River Basins

(Atchafalaya and Mississippi Rivers will be sampled continuously.)

In addition to ambient water quality sampling in the priority basins, the LDEQ has increased compliance monitoring in those basins, following the same schedule. Approximately 1,000 to 1,100 permitted facilities in the priority basins were targeted for inspections. The goal set by LDEQ was to inspect all of those facilities on the list and to sample 1/3 of the minors and 1/3 of the majors. During 1998, 476 compliance evaluation inspections and 165 compliance sampling inspections were conducted throughout the Mermentau and Vermilion-Teche River Basins.

5. Public Participation

When EPA establishes a TMDL, 40 C.F.R. § 130.7(d)(2) requires EPA to publicly notice and seek comment concerning the TMDL. Pursuant to an October 1, 1999, Court Order, EPA prepared this TMDL. After submission of this TMDL to the Court, EPA commenced preparation of a notice seeking comments, information and data from the general and affected public. Comments and additional information were submitted during the public comment period and this Court Ordered TMDL was revised accordingly. EPA has transmitted this revised TMDL to the Court, and to the Louisiana Department of Environmental Quality (LDEQ) for incorporation into LDEQ's current water quality management plan.

REFERENCES

- Carney, Jay. 2000. *Bayou Teche Watershed TMDL for Dissolved Oxygen Including WLAs for Twenty-Two Facilities and Addressing Nutrients, Subsegments 060205, 060301, 060401, 060501*. Louisiana Department of Environmental Quality, Office of Water Resources, Baton Rouge, La.
- Louisiana Department of Environmental Quality. 1993. *State of Louisiana Water Quality Management Plan, Volume 6, Part A: Nonpoint Source Pollution Assessment Report*. Louisiana Department of Environmental Quality, Office of Water Resources, Baton Rouge.
- Louisiana Department of Environmental Quality. 1998. *State of Louisiana Water Quality Management Plan, Volume 5, Part B: Water Quality Inventory*. Louisiana Department of Environmental Quality, Office of Water Resources, Baton Rouge.

APPENDIX A. Sulfate data

Bayou Teche (WQ site 673)

(Data Source: <http://www.deq.state.la.us/surveillance/wqdata/0673wqng.txt>)

This data last updated on: 08/06/00

SULFATE		
DATE	TIME	mg/L
-----	-----	-----
12/02/98	0945	19.7
11/18/98	0843	12.4
11/05/98	0942	42.3
10/21/98	0948	48.3
10/07/98	0948	58.3
09/16/98	0848	8.2
09/02/98	0850	44.2
08/19/98	0817	30.7
08/05/98	0809	34.1
07/22/98	0830	35.2
07/08/98	0755	38.9
06/17/98	0730	48.7

The sulfate criterion was exceeded in 75% of the samples (9 of 12 samples) from June 1998 to December 1998.

APPENDIX B. Flow Information

Bayou Teche at Breaux Bridge (DEQ 031) -- Based on the adjusted runoff for the USGS station on Bayou Teche at Arnaudville and a subtraction of the estimated average flow for Bayou Fusilier, the estimated average streamflow is 760 CFS. The May - October average flow is estimated to be about 76% of the annual average flow; the November - April average flow is estimated to be about 124 % of the annual average flow.